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REPORT UPON WATER POLLUTION CONTROL GUADALUPE RIVER BASIN (LAVACA, NAVIDAD, GUADALUPE AND SAN ANTONIO RIVERS)

Public Health Service
Dallas, Texas

August 1951

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GUADALUPE RIVER DRAINAGE BASIN

Report on Water Pollution Control

1952

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FEDERAL SECURITY AGENCY
Public Health Service

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U.S. Division of Water Pollution Control

FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
Washington, D. C.

REPORT UPON WATER POLLUTION CONTROL
GUADALUPE RIVER BASIN
(Lavaca, Navidad, Guadalupe and San Antonio Rivers)
AUGUST 1951

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Prepared by
FEDERAL SECURITY AGENCY
Public Health Service
Division of Water Pollution Control
Western Gulf and Colorado Drainage Basin Office
in cooperation with
Texas State Department of Health

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INTRODUCTION

The subject of stream pollution has always received considerable attention in the State of Texas. However, pollution abatement has made outstanding progress since 1946 as a result of concentrated efforts by the water pollution control agencies and increasing concern expressed by other public officials, professional and lay groups, and the general public. It is recognized that pollution prevention and abatement measures must be continued or the State's valuable water resources will be seriously damaged and economic development, which is dependent on the water resources, will be greatly hampered.

This report on the Guadalupe River Basin has been prepared to aid in the continued development of the water pollution program to protect the waters of the basin. It is a summary of information and data available as of August 1951 on the uses to which the water resources are put, the pollution reaching the watercourses and the damages resulting from that pollution, the benefits which may result from pollution prevention and abatement, the pollution prevention measures now in effect, and those which are required.

The data presented herein brings together information collected by State and Federal agencies, municipalities and industries, and other interests concerned with the conservation and development of water resources. This report will serve to publicize the water pollution situation and direct the responsibility for needed corrective measures to municipalities and industries involved.

This report is also intended for use by the Public Health Service as part of the nation-wide program. Provisions of the Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress June 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal Agencies, with State and interstate water pollution control agencies, and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters.

It should be recognized that this report is based on data which were readily available in August 1951, but, are admittedly incomplete. The data that appear in this report indicate that much work still faces the State water pollution control agencies in carrying out the water pollution control program for the Guadalupe River Sub-Basin.

Data and knowledge are sufficient to permit immediate solution of most of the basin's pollution problems. The list of pollution abatement projects which are included in Table L of this report represents known needs. Future studies and evaluation may result in some changes in the estimations of requirements.

ACKNOWLEDGEMENTS

This report has been prepared by the Western Gulf and Colorado Drainage Basin Office, Division of Water Pollution Control, Public Health Service in cooperation with:

Texas State Department of Health
Texas Game and Fish Commission
(formerly Texas Game, Fish, and Oyster Commission)
Texas Board of Water Engineers
Texas Railroad Commission

Federal agencies from which assistance was obtained include:

Department of the Army
Corps of Engineers

Department of Interior
Geological Survey
National Park Service
Fish and Wildlife Service

Department of Commerce
Bureau of the Census
Weather Bureau

Department of Agriculture

Federal Power Commission

National Resources Committee

Other valuable sources of information include:

The Texas Almanac
published by the Dallas Morning News

Federal Reserve Bank of Dallas

Directory of Texas Manufacturers
published by the Bureau of Business Research,
University of Texas

Texas Mid-Continent Oil and Gas Association

SUMMARY

The Guadalupe River Basin, located entirely in Texas, includes the watersheds of the Lavaca, Navidad, Guadalupe, and San Antonio Rivers and several minor coastal streams. It is situated in southcentral Texas and extends from the Edwards Plateau to the Gulf of Mexico. The basin contains an area of approximately 13,000 square miles.

The Guadalupe and San Antonio Rivers, with headwaters rising at an elevation of 2,300 feet in the Edwards Plateau, are typical mountain streams until they cross the Balcones Escarpment which is the southern boundary of the plateau.

From the Balcones Escarpment these rivers flow about 250 miles through rolling prairie country and coastal plains to the Gulf. The Lavaca River, in the eastern part of the basin, is a typical meandering coastal plain river.

The climate varies from semi-arid in the upper part of the basin to warm-humid at the Gulf. The annual rainfall varies from 25 inches in the upper part of the basin to 35 inches in the coastal area. At New Braunfels the 39 year average annual rainfall was 30 inches with variations between 13 and 60 inches.

Below the Balcones Escarpment some of the rivers do not reflect the wide rainfall variations since they receive relatively constant discharges from many large springs.

About two-thirds of the basin population of about 773,000 is urban with the largest concentration in and near San Antonio; the industrial, commercial and transportation center of the basin. During the last decade most of the rural areas experienced a population decrease of about 16 per cent while the cities (particularly those of larger size) increased about 60 per cent.

Agriculture is the backbone of the basin's economy. Cattle production predominates in the upper part of the basin while cotton and other row crops, milk production, cattle, and poultry account for most of the farm income in the lower basin. Irrigation is used for crop production in the area west of San Antonio and for rice cultivation in the coastal area.

Oil production provides another large source of income to the basin.

Most of the basin's industries are devoted to the processing of agricultural products, production and refining of petroleum. The San Antonio area contains the basin's only large concentration of industry. It is believed, however, that industry will become increasingly important in the future since adequate industrial water supplies can be developed

from ground or surface sources. During recent years new industries have moved into the basin.

Silt data for the basin are incomplete, but the load which is picked up in the lower part of the basin and carried to the Gulf averages more than 1.5 million tons annually. Compared with the other Texas rivers, however, the rivers of this basin have relatively small silt loads. Although most of the watershed is covered by soil conservation districts, continued conservation measures are needed to reduce this type of pollution.

The Edwards Plateau (Hill Country) area provides swimming, fishing, and boating and is used extensively for recreation. In the lower basin the streams, lakes and reservoirs, and numerous parks provide very good recreational facilities.

The efforts of the Texas water pollution control agencies are evidenced throughout the basin. Pollution control is so well established in the Edwards Plateau recreational areas that no sewage plant effluents are discharged directly into the basin surface waters as far south as New Braunfels. In the remainder of the basin municipal sewage and industrial wastes are treated or disposed of in such a manner that they do not adversely affect the waters. In the Luling oil field and San Antonio areas where pollution affected the basin's waters, court action was effected by water pollution agencies to abate that pollution.

In view of the anti-stream pollution statutes, the State of Texas appears to have a very efficient pollution control program underway. This is reflected in the generally acceptable condition of the major rivers throughout the State.

All of the 44 municipalities which have public sewer systems are served by sewage treatment plants. More than half of these facilities, which include new plants and systems, replaced plants, and enlarged plants, have been constructed since 1946. All of these plants were built to enlarge or improve existing plants or to serve communities installing their first sewer system. In no known instances were municipalities discharging untreated sewage.

At present many of the older plants need improved operation, replacement, addition, or enlargement. It is estimated that the construction of the facilities which the State pollution control agencies consider necessary to correct municipal sewage pollution in this basin will cost about $3,250,000. Pollution from domestic sewage, however, is usually of minor significance and, to date, has caused only local nuisances.

Excluding oil wells, most of the industries in the basin are reported to be connected to city sewerage systems. There are 84 sources of industrial pollution which includes 72 salt water injection wells

used to dispose of oil field wastes to subsurface strata. Data are not in sufficient detail to determine whether these wells are of satisfactory capacity or how many additional wells are needed. Of the 12 other sources of industrial wastes known to discharge directly to the watercourse, 6 have treatment facilities. However, only two of these treatment plants are considered satisfactory.

CONCLUSIONS

1. The Division of Sanitary Engineering of the Texas State Department of Health; the Texas Game and Fish Commission; and the Office of the Attorney General carry on the water pollution control activities in the basin.

2. Evidence of the active water pollution control program of the Texas water pollution control agencies is found in the high degree of sewage treatment throughout the Guadalupe Basin.

3. The further development of the Guadalupe River Basin will depend, in a large measure, on maintaining water of suitable quality.

4. Irrigation is important in the area west of San Antonio where large amounts of surface and underground water are used to supplement rainfall for crop production and in the Gulf coastal area where large amounts of water are used for rice irrigation.

5. A relatively constant flow is discharged to the Guadalupe and San Antonio Rivers by numerous springs. This makes hydroelectric developments with small storage reservoirs practical. However, during the recent dry spell (summer of 1951) the flows of these springs decreased materially.

6. The U. S. Army Engineers plan to build two large storage reservoirs, one on the Guadalupe River and the other on the San Marcos River. These reservoirs will serve to increase the minimum stream flows, reduce the silt content of the streams, dilute undesirable salts and materials, decrease the unsanitary conditions occasioned by flood overflows, provide for sizeable hydroelectric developments, and provide additional recreational areas.

7. The basin's oil fields and the military installations in the San Antonio area are the largest contributors of industrial wastes to the basin waters.

8. The major water damages from pollution are confined to the San Antonio area and Luling oil field area. Correction of these conditions, however, is well advanced.

9. The use of injection wells has materially reduced salt water pollution in the Luling and other oil field areas. Since 1947 there have been a total of 72 salt water injection wells completed in the basin. In spite of the legal and corrective action which has been initiated, some salt water pollution still occurs. Considerable time and personnel are required for enforcement of legal action and abatement of this condition.

10. Pollution from domestic sewage is, in general, confined to localized areas immediately below the point where the sewage plant effluent discharges to the stream. The extensive pollution of a 200 mile stretch of the San Antonio River caused by sewage and industrial wastes from the San Antonio area is in the process of being remedied.

11. Approximately 75 per cent of the basin population is served by sewer systems and 100 per cent of the persons served by sewer systems are also served by sewage treatment plants (17 per cent are primary and 83 per cent are secondary plants). Twelve municipalities, serving about 522,000 persons, are actively engaged in preparing plans and constructing sewage treatment plants to provide a higher degree of treatment for domestic wastes.

12. Silt pollution does not represent a serious problem in a major portion of the basin. Soil conservation programs are well advanced in most parts of the basin. They have as an objective the reduction of erosion with the resultant reduction of silt damages to surface waters.

13. Additional personnel and funds are required by the control agencies concerned with stream pollution prevention and abatement in the basin to intensify and continue the planning and execution of the pollution abatement program.

14. The basin's surface waters in the Edwards Plateau (Hill Country) area are used extensively for recreation. Continued vigilance should be exercised to keep the waters of this area in their present excellent condition. The waters of the lower basin are also used rather heavily for recreation.

RECOMMENDATIONS

It is recommended that:

1. The present program for water pollution control be continued and intensified.

2. All groups and individuals, having an interest in water use and pollution control, cooperate with the official water pollution control agencies in carrying out an educational program to bring the importance of the water pollution control program before the public.

3. The State legislature provide sufficient funds to insure the continuance of an intensified water pollution control program.

4. The State agencies which have water pollution control functions continue their efforts in encouraging municipalities and industry to develop and maintain efficient waste treatment plant operation. This will insure maximum return from investments in treatment facilities.

5. Soil conservation programs be expanded to keep valuable top soil on the land and silt pollution from the watercourses. Also sediment load stations be strategically located to evaluate the present control program and indicate where additional conservation measures are needed.

6. *In accordance with recommendations of the Texas State Department of Health, improved domestic sewage treatment facilities be provided at the following locations:

Floresville	San Marcos	Karnes City
Ganado	Brooks Field	Kelly Field
Halletsville	Edna	New Braunfels
Legion-VA Hospital	Flatonia	Randolph Field
Shiner	Goliad	San Antonio
Waelder	Bexar County Home	Seadrift
Yoakum	State Hospital	Victoria

7. *Improved operation of existing sewage treatment facilities be provided at:

Bexar County Home	San Antonio
Flatonia	Waelder
Karnes City	Legion-VA Hospital

8. *The U. S. Air Forces Installations at Brooks, Kelly and Randolph Air Fields provide adequate treatment facilities to comply with state anti-stream pollution statutes, for the engine repair shop, line operations, and plating shop wastes.

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*Many of the listed communities and industries are actively engaged in providing needed facilities - see Table L.

9. Some satisfactory arrangement be developed to accelerate the procedure for contempt action against violators of existing injunctions.

10. Legislation be considered to provide more positive control over the disposal of oil field wastes whereby the operator is charged with the responsibility for properly disposing of such wastes.

11. Additional gauging and chemical quality stations be established in order to adequately evaluate the water resources of the basin.

HISTORICAL BACKGROUND

The Guadalupe River was named by Alonzo de Leon, a Spanish explorer on an expedition to Texas in 1689. He stated in his account, "we gave the river the name of 'Our Lady of Guadalupe', whom we have brought from Coahuila as our Protectoress."

The Lavaca or "cow" river, which is included in this river basin, was so named by Robert Cavelier Sieur de La Salle, due to the large herds of buffalo seen near the mouth of this stream in 1685 when he landed on the shores of Matagorda Bay to establish Fort St. Louis.

In 1689 the Spanish Priest, Father Manzanet visited the La Salle colony and found that the Indians had killed the adults and adopted most of the children, of whom 10 or 12 were later rescued from the Indian Tribes. The Indians greeted Father Manzanet with cries of "Techas, Techas" meaning "friends, friends". From this expression originated the name of Texas.

From 1715 to 1722, there was a considerable amount of activity among the Spanish in this drainage basin area; this included the establishment of the San Antonio de Valero Mission, which later was to become identified as the famous "Alamo", and a number of other missions.

In 1813, San Antonio, which was then and continued to be the principal Spanish and later Mexican settlement, was captured by Augustus McGee who led a filibustering expedition for the purpose of capturing Texas from the Spaniards. This, like similar expeditions of that period, was ill-fated resulting in defeat and dealth of the leaders.

In 1820, Moses Austin visited San Antonio and through intercession of the Baron de Bastrop, was given a Spanish land grant for his proposed colonies. Following this successful mission, he returned to his home in Missouri to die; to be replaced the following year by his son, Stephen F. Austin, who executed his father's plans so successfully that the State eventually became Anglo-American in its development.

Many incidents leading up to the Texas War for Independence, 1835-36, and the battles fought during the War occurred in the river basin. These included the capture and execution of Texas forces on the battle grounds at Goliad. In 1840, shortly following the War for Independence, troubles occurred with the Comanche Indians starting with the Council House Fight in San Antonio and concluding with the decisive Indian defeat at Plum Creek. In 1841, the Republic of Texas attempted to annex what is now the State of New Mexico. The Mexican Army invaded and held the City of San Antonio as a result. A battle was fought and the Mexican forces were defeated.

In 1844-45, the Mainzer Vereim Society of Germany was active in the establishment of colonies at Indianola and New Braunfels. The community

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at Indianola was swept by cholera in 1846, almost wiping it out. This same community was swept by a Gulf hurricane in 1875, followed 11 years later by a second one that completely destroyed this community which at one time had a population of 7,000 people.

The basin's first oil field was discovered in 1889 and located in Bexar County. This was followed by discoveries in the counties of Medina (1901), Gonzales (1902) and Matagorda (1904). Since 1913 oil discoveries were made at irregular intervals until 1949 when 19 of the 26 counties in this basin had produced or were producing oil.

PHYSICAL DESCRIPTION

This sub-basin, which includes the watersheds of the Lavaca, Guadalupe, and San Antonio Rivers and several minor coastal streams, is situated in southcentral Texas. The area of the basin is approximately 13,000 square miles and is bounded on the northeast by the Colorado River Basin (of Texas), on the southwest by the Nueces River Basin, and on the southeast by the Gulf of Mexico. Maps showing basin location and outline are included throughout the report.

The Lavaca River and its principal tributary, the Navidad, lie in the northeastern part of the basin. They rise in the Coastal Plains region and flow in a southeasterly direction for a distance of approximately 100 miles before entering Lavaca Bay. The Lavaca watershed, with an estimated average annual discharge exceeding 224,000 acre-feet from the Lavaca and 400,000 acre-feet from the Navidad, contains over 2,000 square miles. The maximum flow was more than 73,000 second-feet from the Lavaca and 64,000 second-feet from the Navidad and the minimum flow was about 5 second-feet for the Lavaca and 2 second-feet for the Navidad. The periods of critical low flow occur on the Lavaca and other rivers in this sub-basin in the months of August, September, and October.

The Guadalupe River with its main tributary, the San Marcos River, drains a narrow valley 320 miles long, containing about 6,000 square miles. The average annual runoff at Victoria is 1,365,000 acre feet. The maximum flow of 179,000 second-feet occurred in July 1936 while the minimum of 232 second-feet occurred in August 1948. The river rises in Kerr County in the Edwards Plateau region and flows in a southeasterly direction to San Antonio Bay. The flow is sustained by numerous springs many of which are located at the Balcones fault zone; the two largest springs being the Comal at New Braunfels with an average discharge of approximately 320 cfs and the San Marcos at San Marcos with an average discharge of approximately 100 cfs.

The San Antonio River flows along the southern edge of the basin. It has a drainage area of more than 4,000 square miles with an average annual runoff of more than 380,000 acre-feet. A maximum flow of almost 34,000 second-feet was reported at Goliad, Texas, in July 1942, while a minimum of 44 second-feet was reported in 1927. The headwater source is the Medina River which rises in Bandera County in the Edwards Plateau region and flows in a southeasterly direction until it joins the San Antonio River about 12 miles south of the City of San Antonio. The main stem of the river has its source within the city from several large springs discharging a combined flow of over 50 cfs. From the City the San Antonio River flows in a southeasterly direction to its junction with the Guadalupe River, some 12 miles from San Antonio Bay. Cibolo Creek is a major tributary.

Over a period of years the annual discharge from many of the basin's larger springs have experienced decreased annual flows. The low flows

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of most of the springs, caused by the recent drouth period which occurred during the summer of 1951, were of considerable significance.

Both the San Antonio and Guadalupe Rivers begin in the beautiful "Hill Country" as typical clear mountain streams. Large flows are picked up at the Balcones Fault Zone from the numerous springs. From the fault zone to the Gulf a small silt load (when compared with other Texas streams) is picked up.

There are no large storage reservoirs, except Medina Reservoir with a capacity of over 254,000 acre-feet, in the basin although there are many small hydroelectric developments. Two relatively large reservoirs have been planned by the Army Engineers. These are the Gonzales Dam (construction proposed) on the San Marcos River at river mile 5 with a maximum storage capacity of almost 539,000 acre-feet and the Canyon Dam (construction authorized) on the Guadalupe River at river mile 303 with a maximum storage capacity of more than 1,145,000 acre-feet. These dams are designed as multipurpose projects serving flood control, irrigation, power development, and recreational interests.

The climate of the basin varies from semi-arid in the upper portion of the basin to warm-humid along the Gulf. The average growing season or frost-free period is more than 260 days. The line of 25 inch annual rainfall crosses the upper part of the basin while the lower gulf area has an average rainfall of about 35 inches. At New Braunfels the 39 year average annual precipitation is 30 inches with variations from a minimum of 13 inches to a maximum of 60 inches. The upper portion of the basin has very intense rainfalls of moderate duration while the coastal area has intense rains of long duration. The average annual evaporation at New Braunfels is about 60 inches.

The surface geology is best characterized by the principal soil and land use areas of the basin. They occur from the headwaters to the mouth as follows:

1. Edwards Plateau area - much rough land; shallow stony soils of limestone origin; live oak and shin oak brush; land used for grazing; cattle, sheep and goats represent principal production.

2. Black Prairie area - level to rolling topography; black fertile soils of varying depths; land used mostly for farming; cotton and corn represent principal production.

3. Post Oak area - mostly level topography; sandy and sandy loam soils; farming mostly on interior prairies and bottom lands; cotton, corn, truck crops and beef represent principal production.

4. Coast Prairie area - level topography with poor drainage; varying soils; black and grey clays, some sandy types; land used for farming and grazing; cotton, corn, rice, and beef represent the principal production.

There are several water-bearing formations under the basin. These are in ascending order: Edwards Limestone, Wilcox Group, Carrizo Sand, Catahoula Tuff and Sand, Oakville Sandstone, Lagarto Clay, Goliad-Willis-Lissie Group, Beaumont Clay and recent alluvial deposits. These formations have an increasing depth as they approach the Gulf. Each has an outcrop area from which it dips beneath other formations. Because of these outcrops, surface pollution has a chance to enter the underground water streams. Bacterial and organic pollution is probably dissipated in the upper layers and should not reach the area from which the water is drawn. Soluble inorganic pollution may work down to the withdrawal areas and could affect the characteristics of underground water supplies.

Some of these formations crop out in the Luling Salt Flat oil field area, the basin's major salt water producing field. Pollution of the surface water traversing these outcrops might contaminate these water bearing formations unless continued control is exercised by the State water pollution control agencies.

ECONOMIC DEVELOPMENT

General

The economic development of the Guadalupe River Basin is based upon agriculture and oil production. Most of the industries in the basin are devoted to the processing of agricultural and petroleum products and have the largest concentration in the San Antonio area. Military activities, particularly in the San Antonio area, have also played a significant role in the basin's economic development. In the upper part of the basin, recreational activities support an important part of the economic structure.

Population

The population of the Guadalupe River Basin increased from approximately 620,000 persons in 1940 to about 773,000 persons in 1950 which represents a gain of almost 25 per cent. Comparatively, the State of Texas had an increase of approximately 20 per cent. In 1950 about 243,000 people or 31 per cent lived in rural areas and 529,000 people or 69 per cent lived in urban areas (cities with population of over 2,500). In 1940 almost 290,000 people or 47 per cent lived in rural areas while about 330,000 people or 53 per cent lived in urban areas. These data do not include the military personnel stationed in the basin.

There are 18 cities in the basin which fall in the 2,500--10,000 range. Their combined population increased approximately 39 per cent during the 1940-50 decade.

Two cities now in the 10,000--20,000 range had a combined population increase from approximately 9,000 to 28,000 or about 230 per cent during the 1940-50 decade.

The City of San Antonio experienced the largest population increase in the basin. The growth during the 1940-50 decade was from approximately 254,000 to 407,000 an increase of about 60 per cent.

The total urban growth in the basin from 1940 to 1950 was from approximately 330,000 to 529,000, a percentage increase of about 60. The basin's population increase has occurred in the urban areas, particularly in those of larger size. Rural areas had a marked decrease.

The trend established during the past 10 years shows that almost all towns and cities are becoming larger while almost all rural areas are losing population. This trend has had a marked effect on pollution abatement needs as larger municipalities mean increased volumes of sewage.

Communities which heretofore did not have sewers grew to the point where such facilities were desirable, while many of the already sewered communities grew to the point where their systems and treatment plants

were no longer sufficient in capacity. This, together with the educational and promotional activities of the pollution control agencies for better sanitary facilities has resulted in an increase in the construction of numerous new systems and treatment plants and the replacement or enlargement of many existing systems and plants.

The many military installations in the basin have strengthened the basin's economy. This is particularly apparent in the San Antonio area where there is a concentration of these establishments. These are the School of Aviation Medicine at Randolph Field; Brooks Army Medical Center, rated one of the largest and finest military hospitals in the world; Camp Stanley; Camp Bullis; Fort Sam Houston, the largest military installation in the nation; and Randolph, Brooks, Kelly and Lackland Air Force Bases, representing the world's largest capital investment in aviation.

Appendix II shows census figures for communities with a population of 1,000 or more persons and other population data.

Agricultural Development

Crop and livestock production is the basic industry in the basin economy. Livestock raising, principally cattle, sheep, goats, and horses, was the first activity in which early Texans engaged. Livestock constituted the main assets of the Spanish missions in the Eighteenth Century. The Spanish cow was the pioneer of beef development, and today's Rambouillet sheep and Angora goats are decendents of animals brought to the Southwest by Spaniards and Mexicans. Ranching remained the principal industry until cotton, corn, and other row crops were introduced by immigrants from the Southern States shortly before the Civil War.

The colorful cattle drives were developed to reach good markets. These drives constituted the only means of transporting cattle until the advent of railroads in the 1870's. The railroads provided easy access to markets and stimulated livestock production. Other factors which added the livestock development was the introduction of barbed wire and windmills.

During the middle of the 19th Century farmers began to get a foothold in the basin. At first there were many attempts on the part of the cattlemen to keep them from fencing-in what had previously been open range land. Farmers, however, were not to be denied the broad expanse of fertile land which would readily grow cotton, grains, and other row crops, and these are now a major source of income.

Cotton represents a large source of income for the basin, but there has been a considerable decrease in production since the turn of the Century. The future for cotton cannot be predicted; however, the tendency seems to be towards diversified rather than specialized farming. In 1949 the cotton crop in the Guadalupe River Basin, based on bales ginned, was about 202,000 bales or 4 per cent of the total Texas crop.

During the last ten years there has been an increase in production of corn, grain sorghums, flax, peanuts, and other row crops in the lower portion of the basin. There are some truck farms in this area which supply local markets.

Beef cattle production is the leading livestock enterprise in this area. In addition, a sizeable dairy industry supplies milk for local markets.

Poultry production is of considerable importance in the central part of the basin. In 1948 approximately 12,000,000 broilers or 75 per cent of the state total was produced in Gonzales County alone. In addition, there is a large production of eggs and turkeys.

The lumbering industry is of little importance in the basin, being limited to the production of cedar and oak posts.

Minerals

This basin is not as rich in mineral resources as some other portions of the State, but petroleum provides a major source of income to the area, while sand, gravel, bleaching clays, and brick clays are available in adequate quantities for some industrial uses. In 1949 almost 32 million barrels of oil, 4 per cent of the total Texas production, was produced in the basin. Although exploratory operations have been maintained in various sections of the basin no important fields have been discovered since the Falls City field was opened in 1944.

Particular attention must be given to oil field and refinery wastes. Usually the older fields produce large amounts of brine. Methods must be developed for its proper disposal. Many of the wells, especially those of the Luling Salt-Flat field, are now producing large amounts of brine. Brine from this area is reported to have affected the municipal water supply of Gonzales and fishing conditions in the San Marcos River. Action has been initiated leading to the correction of pollution in this area.

Manufacturing

Practically all manufacturing in the basin is limited to the processing of agricultural products and the refining of petroleum. Most of the basin's industries are located in the San Antonio area while several other urban centers have a few industries. Manufacturing will undoubtedly take an increasingly important role in the future, since water for industrial use appears to be abundant. During recent years several industries, both large and small, have moved into the basin. They are industries which may grow considerably and accordingly increase the industrial waste load in the basin.

There have been no reports of serious damage to water resources by pollution from industry other than from oil field wastes and wastes from military installations in the San Antonio area.

Availability of water represents an important asset for the industrial development of this basin, and it is important that waters be kept free of pollution.

Cheap electric power may also have a marked effect on industrial development in the basin. The Comal Steam Plant at New Braunfels and several small hydroelectric developments on the Guadalupe and San Marcos Rivers are operated by the Lower Colorado River Authority and other companies. The Lower Colorado River Authority District is composed of 10 counties bordering the Lower Colorado River, however, the Authority serves 13 counties, which are wholly or partially in the Guadalupe River Basin, with electric power. Most of the larger municipalities in the upper part of the basin including part of San Antonio are supplied with L. C. R. A. power.

Transportation

There are adequate transportation facilities throughout the basin. The area is covered with a network of first and second class highways. There are in addition many railroads, airlines, bus companies, oil and gas pipelines and trucking companies which regularly serve the basin.

Recreation

Recreational assets of the basin consist of scenic areas, many parks, many streams, numerous lakes, and the Gulf Coast area. The upper part of the basin is particularly attractive to tourists, hunters, and fishermen.

Fishing is reported to be good in the upper and fair in the lower parts of the basins. Black and white bass, catfish, drum and sunfishes are the types most sought by fishermen. Fishermen are also attracted to the Gulf Coastal regions for salt water fishing.

Game and fur-bearing animals found in the basin include white tail deer, squirrel, racoon, muskrat, rabbit, mink, opossum, skunk, and weasel. Game birds include quail, dove, turkey and migratory water fowl. The "Hill Country" or Edwards Plateau region is particularly noted for its abundant game and each year attracts many hunters to the area.

Administration

There are at least 23 administrative agencies that have some type of control over the waters of the basin. Three of these are Federal and six are State organizations and operate in the entire basin. The other 14 are local in character and have jurisdiction within a limited portion of the basin. Appendix III lists these agencies.

USES OF WATER RESOURCES

The ground and surface waters of the Guadalupe River Basin provide excellent water supplies. Supplies are generally adequate for present uses and available for many new uses. At times, however, the unregulated river flow is not large enough to supply the demand especially during rice irrigation seasons. Storage projects are needed to hold flood waters for use during the low flows. Additional gauging and chemical quality stations strategically located are considered desirable for background information to permit water use program formulation. The existing primary water uses are shown graphically on Map No. 1.

Surface waters of the basin are utilized for domestic water supplies, irrigation, industrial water supplies, hydroelectric power generation, recreation, and waste disposal. Of these uses power generation, irrigation, and recreation have the greatest economic significance at the present time.

All low flows of the basin have been appropriated. A recent report from the Texas Board of Water Engineers shows that there is plenty of flood water in the basin which has not been appropriated. A brief summarization of the report follows.

Although the average annual flow near the mouth of the Lavaca River is more than 224,000 acre-feet and 400,000 acre-feet from the Navidad, the appropriations (all for irrigation) for the watershed total only about 11,000 acre-feet.

The amount of water estimated to be necessary to meet all allocations on the Guadalupe River above Victoria approximates 25,000 acre-feet. This figure does not include more than 876,000 acre-feet of appropriated, non-consumed water required for the production of hydroelectric power. The average annual flow of the Guadalupe River at Victoria is 1,365,000 acre-feet.

Almost 330,000 acre-feet of water is estimated to be required for all allocations on the San Antonio River above Goliad, which includes approximately 300,000 acre-feet from the Medina River for irrigation. However, available water is not sufficient to satisfy these allocations. The average annual flow at Goliad is approximately 426,000 acre-feet.

The State interpretation of the State's anti-pollution statutes implies that surface waters are to be maintained at the highest possible quality and consequently all water uses are being considered and protected by the present pollution control program. Because of the determination that the highest possible water use must be protected no allowance is given by enforcement agencies for dilution. Consequently, the Texas State Department of Health considers the determination of water quality for specific uses, although of concern, as economically unjustified at present. They believe that the facilities and personnel can be better

- DOMESTIC WATER SUPPLY
- INDUSTRIAL WATER SUPPLY
- LIVESTOCK
- IRRIGATION
- COMMERCIAL FISHING
- BASE FISHING
- SHELLFISH
- WILDLIFE
- BATHING WATER
- OTHER RECREATION
- NAVIGATION

GUADALUPE RIVER BASIN
LOCATION MAP

SCALE OF MILES

GUADALUPE RIVER BASIN

EXISTING PRIMARY WATER USES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 1

used in securing needed pollution abatement facilities.

There are only three municipalities in the basin which get their water from surface supplies. These three serve approximately 19,000 persons with 2 million gallons per day. Forty-five municipalities use ground water from the abundant supply of good quality artesian water. These municipalities supply an estimated population of over 488,000 with more than 53 million gallons of ground water per day. The ground water supplies appear adequate for most municipalities; however, if necessary, this source may be supplemented by the development of excellent surface waters. Appendix IV contains a tabulation of data on municipal water supplies.

Many individual domestic and livestock supplies are also obtained from the basin's ground and surface waters.

Irrigation has not been extensively practiced due to adequate rainfall throughout most of the basin. However, there has been considerable crop irrigation in the area west of San Antonio.

In recent years there has been a substantial increase in rice irrigation in the counties of Victoria, Calhoun, and Jackson near the Gulf. Continued control must be exercised to see that this use is not affected by brine pollution from the oil fields in the basin. Rice growers have also experienced difficulties during peak demand periods when stream flows do not satisfy the demand and brackish water is pumped upstream. Corrective measures to relieve this condition have been taken in some areas.

Industry uses as much water as is used for domestic purposes. This water is obtained from ground and surface sources and since no evidence to the contrary has been uncovered it is assumed that these waters are satisfactory to industry. In the past few years new industries have moved into the basin indicating that water of suitable quality is available. The abundance of water favors the advent of even more industrial plants if provision is made for storage of flood waters to supplement low flows.

Additional water quality stations are deemed advisable in some areas to secure water quality data for use by industries when selecting future plant sites.

Surface water is used extensively for the production of electric power. There are, however, no large hydroelectric reservoirs in use inasmuch as the river flows are sufficiently constant to provide the necessary water to meet present power demands. Seven of the many hydroelectric reservoirs in the basin have an average storage capacity of only 4,000 acre-feet.

The authorized Canyon Dam on the Guadalupe River and the proposed Gonzales Dam on the San Marcos River will, when constructed, have many

beneficial effects on the water uses in the basin. These reservoirs will serve to reduce the silt content of the streams, increase minimum stream flows, dilute undesirable salts and minerals, decrease the unsanitary conditions occasioned by flood overflows, make a considerable amount of electric power available, and provide sizeable recreational areas. More water of improved quality will be made available to present and future users by these projects.

Probably the greatest single use of the surface waters in much of the basin is for recreational purposes. A large tourist and vacation trade is attracted each year to the fresh clear water in the upper part of the basin (the "Hill Country"). More than 400 camps, tourist courts, and dude ranches and thousands of summer homes are located in this area where the waters offer excellent facilities for swimming, fishing, and boating. It has been emphasized by State Health Department Engineers that abatement and prevention of pollution are of extreme importance in this area both from a public health and an aesthetic point of view. At present all sewage plant effluents discharge to the land in this area.

Although not as attractive as the upper part of the basin, the lower reaches of the river are utilized to a considerable extent for recreational uses. Intensive use is also made of the waters for recreational purposes in the units of the Texas State Park Board, such as, the Kerrville State Park at Kerrville, the Palmetto State Park near Gonzales, the Lockhart State Park near Lockhart, and the Goliad State Park near Goliad; and in the rather heavily used municipal and private recreational developments at New Braunfels and San Marcos.

There are four fish hatcheries located in the basin, one Federally operated and one State operated at San Marcos, and two state establishments at Natalia and Mt. Home. These hatcheries keep the waters of the basin as well stocked with fish as conditions permit.

Salt water fishing is of considerable importance in the Gulf of Mexico near the mouths of the rivers of the basin. In common with most of the Gulf of Mexico coastline, these waters are utilized by both commercial and sport fishermen.

The waters of the basin are also used for the final disposal of municipal and industrial wastes. At 5 of the 47 municipal treatment plants, the plant effluent has been utilized for land irrigation and does not reach surface water. Efforts of the State Health Department have resulted in sewage being given a high degree of treatment and, in general, the capacity of the streams to assimilate these wastes has not been overtaxed at present.

POLLUTION CONTRIBUTED TO WATER RESOURCES

All of the sewered municipalities in this basin have treatment plants and are giving their sewage some degree of treatment. Eight municipalities[1] are served by 8 primary treatment plants, and 37 municipalities[2] are served by 39 secondary treatment plants. Seven of these plants are known to need improved operation. Twenty-one plants are considered unsatisfactory from a physical standpoint and need replacement, additions, or enlargement.

Table A shows that 40 municipalities serving over 153,000 persons discharge treated wastes with a total population equivalent of approximately 27,500 to the waters of the basin. This population equivalent was calculated from analytical data or estimated plant efficiencies.

The population equivalent of effluent being discharged by 4 municipal sewage treatment plants, serving approximately 448,000 persons, is undetermined. The City of San Antonio, which serves more than 445,000 persons, is the largest city in this undetermined category and has been the basin's major contributor of pollution from domestic sewage and industrial wastes. Improved conditions, however, should be effected by plant enlargements and more effective plant operation.

The Veterans Administration's Hospital at Legion, Texas, is discharging a sewage plant effluent which is unsatisfactory. During dry periods the effluent, which is discharged on pastureland, puddles on a hillside acreage and causes fly, mosquito and odor nuisances. Whenever there is any rain, the effluent is washed to a small stream which drains to the Guadalupe River. This condition will be corrected in the near future.

The sources of municipal pollution are shown graphically on Map No. 2.

1/ Includes one municipality with both a primary and a secondary treatment plant.

2/ Includes two municipalities each with two secondary treatment plants.

TABLE A

SOURCES OF POLLUTION

MUNICIPAL

August 1951

Municipalities*	Sources of Pollution (In Number of Municipalities*)	Population Served by Sewerage System	Amount of Pollution Discharged to Watercourse (In Terms of Equivalent number of People)**
Having data on pollution load discharged to watercourse	40	153,330	27,477 (1)
Having population data available (Data on pollution load to watercourse incomplete or not available)	4	447,640 (2)	undetermined
TOTAL	44	600,970	xxxxxxx

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.

** Includes industrial wastes discharged into municipal sewerage systems.

(1) Includes 5 municipalities which discharge to land irrigation or lagoons.

(2) Includes population served (445,000) by the San Antonio treatment plant--the plant operation being in a period of transition.

While most of San Antonio's industrial wastes are discharged to the city sewers, pen wastes from 3 packing houses and 1 stockyard are discharged directly to the watercourse and cause nuisance conditions at times. A recent preliminary industrial waste survey for the City of San Antonio was made by State and City engineers to determine the load contributed to the city sewerage system by industry. The wastes from San Antonio's industries, except as noted above, are treated by the city sewage treatment plant and do not constitute separate sources of pollution. Two hundred forty-three industries, composed of 22 meat or poultry packing plants, 6 animal hide products plants, 2 breweries, 3 milk processing plants, 2 photography developing establishments, 16 carbonated beverage bottling plants, 17 steel and iron fabrication plants, 16 food processing plants, 159 miscellaneous industries including laundries, canneries, soap manufacturers and others, have been surveyed. These 243 industries employ more than 10,000 persons.

SOURCES OF MUNICIPAL POLLUTION

POPULATION EQUIVALENT (1000) OF WASTES DISCHARGED TO STREAM

- 0
- 1-500
- 500-5,000
- 5,000 AND OVER
- UNDETERMINED

EXISTING TREATMENT FACILITIES

- MUNICIPALITIES WITH TREATMENT FACILITIES
- MUNICIPALITIES WITH TREATMENT FACILITIES UNDETERMINED
- MUNICIPALITIES WITH NO TREATMENT FACILITIES

GUADALUPE RIVER BASIN
LOCATION MAP

SCALE OF MILES

0 5 0 0 10

GUADALUPE RIVER BASIN

SOURCES OF MUNICIPAL POLLUTION AND EXISTING TREATMENT FACILITIES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 3

One hundred and one of these industries, for which flow data are available, contribute more than 4 MGD to the city sewers. The quantity and quality of these wastes are under investigation at the present time.

The Air Force installations at Brooks, Kelly, and Randolph Air Fields near San Antonio are reported to be dumping large quantities of oil and plating wastes from their engine repair and plating shops and line maintenance into the storm sewers. Although some attempt has been made to lagoon these wastes, they are adversely affecting small streams which are tributary to the San Antonio River. It is reported that these tributary streams are unfit for all uses.

There are 72 industries located in the basin outside the San Antonio area. Most of these industries discharge to city sewer systems, and their wastes have a noticeable effect on the strength of raw sewage which is handled by city treatment plants. These include 24 meat and poultry packing plants, 15 milk processing plants, 1 brewery, 1 carbonated beverage plant, 2 animal hides products plants, 19 food processing plants, 3 chemical products plants, and 7 miscellaneous industries. All but 3 of these industries provide suitable waste disposal or discharge to city sewer systems.

The sources of industrial pollution are shown on Map No. 4. Due to the limited field personnel of the water pollution enforcement agencies it has been necessary to follow a policy of investigating only those pollution conditions which are reported to the agencies in the form of complaints. Consequently, it is entirely possible that minor pollution situations exist and have not been investigated.

TABLE B

SOURCES OF POLLUTION

INDUSTRIAL*

August 1951

Industries*	Sources of Pollution (In Number of Plants)	Amount of Pollution Discharged to Watercourse (In Terms of Equivalent Number of People)
Producing Organic Wastes	1	100
Producing Organic Wastes	10**	Undetermined
Producing Inorganic Wastes	75***	Not Applicable
Producing Wastes of Undetermined Type	1	Undetermined
TOTAL	84 /	xxxxxxxxxxx

* Industries having separate outlets discharging wastes directly to watercourse.

** Includes 3 industries which are also producing inorganic wastes.

*** Includes 72 salt water injection wells used to dispose of oil field wastes into subsurface strata from an unknown number of producing oil wells.

/ Total adjusted to correct for duplication noted in footnote marked thus **.

Table B shows that there are 84 sources of industrial pollution in the basin which have separate outlets and do not discharge to municipal sewer systems. Seventy-two of these are salt water injection wells which are used to dispose of oil field wastes to subsurface strata. The total number of wells in the basin producing waste of a polluting nature or the amount of wastes produced is unknown. However, it is estimated that these 72 wells discharge more than 16 million gallons of brine daily to underground strata (containing non-potable water). The quality and quantity of wastes from the other 12 sources of industrial pollution are unknown except in the case of one industry which produces an organic waste with a population equivalent of 100.

Oil fields are considered the basin's major source of pollution from industrial wastes. Of particular concern are those producing salt brine, such as the Luling "Salt Flat" field. It was reported by the U. S. Fish and Wildlife Service that fishing conditions had been rendered poor in the San Marcos River below Luling by brine and oil wastes discharged into

NO TREATMENT NEEDS

TREATMENT NEEDS UNDETERMINED

TREATMENT NEEDED

TREATMENT NEEDS INDICATED BY LETTERS APPEARING BESIDE 'TREATMENT NEEDED' SYMBOLS, AS FOLLOWS

- B — ENLARGEMENTS OR ADDITIONS TO EXISTING PLANT
- C — REPLACE EXISTING PLANT
- CL — CHLORINATION
- E — ABANDON PLANT AND CONNECT TO OTHER SYSTEM
  - * To Kerrville sewers
  - ** To San Antonio sewers

NOTE
Numbers next to symbols or next to code letters represent number of treatment needs in the category designated

GUADALUPE RIVER BASIN
LOCATION MAP

SCALE OF MILES

GUADALUPE RIVER BASIN
MUNICIPAL
WASTE TREATMENT NEEDS

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 4

Plum Creek. Visual inspection of the river banks of this area show some petroleum residue, apparently oil, on the vegetation.

The City of Gonzales offers an excellent control point for evaluating this pollution as its water supply is obtained from the river below the sources of the oil and brine wastes. Daily analyses made at the city water treatment plant have, since the initiation of legal proceedings, shown chlorides which exceed 500 ppm. on a few occasions for short periods of time. The City Manager reports that the condition has improved considerably and during the last year the chlorides fell in the range of 100 ppm. This improvement is believed to be due largely to disposal of brine through injection wells by most oil companies.

All complaints of oil field pollution which have been reported to the water pollution control agencies have been investigated and corrective action initiated in each instance. Since 1947 there have been about 72 salt water injection wells placed in operation in the basin.

The problem of silt pollution in the Guadalupe River Basin is not of the same magnitude as that of other rivers in the Western Gulf Drainage Basin. Silt dataare not complete, but from records readily available for the lower part of the basin, the average load appears to be in the range of 500 parts per million, however, during a large part of the year the concentration rarely reaches this value. Some improvement can be anticipated from the development of soil and water conservation practices throughout the basin.

Although pollution abatement in the Guadalupe River Drainage Basin can be improved, water uses do not suffer to a discernable extent from pollution contributed at the present. If the silt load can be reduced in the lower part of this basin, and the several localized adverse conditions corrected, the basin waters could be considered excellent for all uses.

DAMAGES TO WATER RESOURCES FROM POLLUTION

The Texas State Department of Health considers the downstream watercourse status as "Unsatisfactory" below the municipal treatment plants at New Braunfels, Brooks Field, State Hospital (San Antonio), Floresville, Edna, and Karnes City. A "Local Nuisance" condition exists in the downstream watercourse below treatment plants at Ganado, Goliad, Halletsville, Legion, San Antonio, Kelly Field, Randolph Field, Waelder, and Yoakum.

The U. S. Fish and Wildlife Service reports that fishing has been "poor" in the San Marcos River from Luling to the point where the San Marcos discharges into the Guadalupe (a distance of about 35 miles) due to oil field pollution. Conditions, however, have improved considerably since corrective measures have been initiated.

The U. S. Fish and Wildlife Service also reported that fish and wildlife have been seriously affected below the City of San Antonio for 10 miles in the Medina River and in a 150 mile reach of the San Antonio River. This condition is attributed to domestic sewage and industrial wastes from the City of San Antonio and the military installations in that area. The sewage plant effluent is discharged to Mitchell Lake which acts as a holding lagoon for the plant effluent and contains an abundant algae growth. This lake drains to the Medina River which flows into the San Antonio River. The algae that reach the river in this way die and decompose with a resulting depression in the dissolved oxygen supply of the water.

Although the treatment plant at San Antonio has been enlarged recently, State Department of Health personnel feel that the condition below the city will not improve unless minor additions and enlargements and proper operation of the plant and appurtanences are provided.

Oil and plating wastes from Kelly, Brooks, and Randolph Air Fields are reported to seriously affect the waters of several small streams which flow into the San Antonio River. It is reported that fish have been killed and all water uses impaired in these small streams by these wastes.

Data on oyster production in the bays along the coast are not sufficient to evaluate the effects of silt. It is known, however, that production has dropped off considerably in recent years. Much of this decrease is attributed to the large deposits of silt in the oyster producing bays.

Except in these few instances damages to the water resources from pollution seem to be of unusual occurrence.

BENEFITS RESULTING FROM POLLUTION PREVENTION AND ABATEMENT

Benefits from pollution abatement measures are difficult to evaluate. The universal installation of domestic sewage treatment plants in this basin has unquestionably improved health, welfare, property values and personal enjoyment as well as kept the water resources available for new users.

The abatement of the pollution of the Guadalupe River by the discharge of brine and oil wastes from the Luling Salt Flat oil field area, which, in the past, affected the water supply of the City of Gonzales, will insure the city a permanently satisfactory supply.

The elimination of this source of pollution will also improve fishing and other recreational uses on the San Marcos River.

Minor additions and enlargement of the San Antonio sewage treatment plant will make the San Antonio River more desirable for all uses after proper plant operation has been established. A great improvement can be expected from a biological, public health, and aesthetic point of view.

Since the waters in the upper part of the basin are used extensively for recreation and waters in the lower part of the basin are also used considerably for recreation, it is of extreme importance that the streams continue to be kept free of pollution. This will enable residents of the area to continue to benefit economically from an increase in tourist trade and vacationers to continue to benefit by the enjoyment of more desirable recreational waters.

The elimination of the pollution of the small streams which are tributary to the San Antonio River, caused by oil and toxic wastes discharged from Brooks, Kelly, and Randolph Air Field's engine repair shops, will improve the affected waters for domestic and industrial uses, livestock watering, and recreation.

The elimination of silt pollution from the waters of the basin by soil conservation practices will result in many benefits. Municipalities and industries will be saved the increased cost of water treatment, farms and ranches will not suffer the loss of valuable top-soil and fertilizers, the dredging of navigation channels will be reduced, and sportsmen will realize more profitable fishing.

POLLUTION PREVENTION MEASURES IN EFFECT

The Texas agencies which have water pollution control functions consider their present laws adequate to correct any cause of pollution. A brief discussion of these laws follows:

In 1913 Texas passed legislation prohibiting the pollution of any "watercourse or other public body of water." The State Board of Health was designated to enforce the provisions of the Act and the State Game and Fish Commission was given permissive jurisdiction for the protection of fish and oysters. In 1945 a General Sanitation Law was adopted which established minimum standards of sanitation and health protection measures and gave to the State Department of Health the specific responsibility for establishing necessary rules and regulations and the enforcement thereof.

The State Department of Health has been designated by the Surgeon General, pursuant to the Federal Water Pollution Control Act, as the State Water Pollution Agency.

Jurisdiction is state-wide and covers pollution of any water course or other public body of water from which water is taken for the uses of farm livestock, drinking and domestic purposes. The responsibility is shared with the Game and Fish Commission, insofar as protection of fish and oysters is concerned.

Responsibility is further shared with all home rule cities which have the right to prevent pollution of their public water supply and with all of the many water improvement and conservation districts both for surface and sub-surface waters. These water districts have the right to establish rules and regulations protecting water resources within the area of the district from pollution.

The State Land Commission is responsible for determing that oil well developments do not pollute surface and sub-surface waters in State owned lands. The enforcement of the Land Commission rules and regulations is handled by the Fame and Fish Commission unless it involves pollution of water used for drinking, domestic purposes or livestock, when the State Health Officer assists in enforcement.

The existing State anti-stream pollution statutes have proven quite satisfactory according to the officials of the State agencies having water pollution control functions. These laws have been interpreted by the courts to imply that all wastes discharged into a watercourse of the State shall be of such a nature as to not materially affect the quality of the receiving waters. Thus, in effect, the Texas Legislature has established the policy that the best water use shall be the highest water use. The enforcement agencies have followed a policy of attempting to maintain waters of the highest possible quality throughout the State.

The water pollution control activities of the Texas State Department of Health have been very effective in providing treatment for domestic sewage. Through the efforts of this agency, (see Table C) 8 municipalities have provided primary treatment plants which serve over 12,000 persons and 37 municipalities have provided secondary treatment plants which serve almost 589,000 persons. All sewered municipalities in the basin are served by sewage treatment plants. The 1950 population of all municipalities served by sewer systems is approximately 592,000 exclusive of the sizeable number of personnel stationed at the various military reservations. Map No. 2 designates existing municipal sewage treatment facilities.

Until recently some truck farms near San Antonio were irrigating vegetable crops with partially treated sewage. This practice has been stopped by a court injunction currently in effect.

TABLE C

EXISTING TREATMENT FACILITIES

MUNICIPAL

August 1951

Degree of Treatment Provided	Number of Municipalities* Served	Number of Treatment Plants	Population Served
Primary	8 (1)	8	12,050
Secondary	37 (1) (2)	39	588,920
No Treatment	None	None	None

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.
(1) Includes one municipality with a primary and a secondary plant.
(2) Includes 2 municipalities each with 2 secondary plants.

Industrial wastes disposal has not been a pressing problem except in the brine producing oil field areas. Table D indicates that there are 12 industries known to discharge wastes directly to the watercourse, but only 6 are giving their wastes some degree of treatment. The other 6 have no treatment.

The State Health Department's efforts to abate brine pollution in the Luling area have shown results. The complete correction of this problem will require continued effort. Most of the oil companies in this area are using brine injection wells. There are 72 of these injection wells in the basin which have been completed since 1947. However, some operators still use holding ponds and lagoons from which water evaporates,

seeps into the ground, or is discharged into the streams during high river flows when adequate dilution is available. The 72 injection wells are disposing a total of more than 16 million gallons of salt water wastes per day.

The State Department of Health has asked the authorities at the Air Force installations at Brooks, Kelly and Randolph Fields to eliminate the pollution caused by oil and other toxic wastes discharged into storm sewers. Kelly Field is actively planning corrective action. Map No. 4 designates existing industrial waste treatment facilities.

TABLE D

EXISTING TREATMENT FACILITIES

INDUSTRIAL*

August 1951

Type Industry	Number of Plants	Number of Industrial Plants Having: Treatment Facilities	No Treatment Facilities	Undetermined Facilities
Food and Allied	7	1	6	
Chemical and Allied	1	1		
Petroleum and Allied	72	72**		
Primary Metals	1	1		
Miscellaneous	3	3		

* Industries having separate outlets discharging wastes directly to watercourse.
** Includes 72 salt water injection wells disposing of oil field waste from an unknown number of oil wells.

Since the streams in the upper part of the basin (the "Hill Country") are used largely for recreation, the State Health Department personnel have endeavored to keep all sewage and sewage plant effluent from the watercourse. At the present time all sewage plants in this area discharge their effluent to closed lagoons or distribute it over the land by broad irrigation.

The maintenance and operation of a majority of the sewage treatment plants are such that very good effluents are being produced. Table E indicates that the adequacy of existing treatment facilities with relation to: capacity is satisfactory in the case of 26 plants, and unsatisfactory in the case of 21 plants; and operation is satisfactory at

40 plants, and unsatisfactory at 7 plants. The plants which are of unsatisfactory capacity need replacement, additional facilities, enlargement, or, in some cases, connection to nearby city sewer systems.

TABLE E

ADEQUACY OF EXISTING TREATMENT FACILITIES

MUNICIPAL*

August 1951

Number of Municipal* Treatment Facilities	Adequacy With Relation To:					
	Capacity			Operation		
	Sat.	Unsat.	Undet'd	Sat.	Unsat.	Undet'd
47	26	21	None	40	7	None

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.

Table F shows the adequacy of existing industrial treatment facilities. There are 6 industries in the basin which give their wastes some degree of treatment before discharging to the watercourse. Also 72 injection wells used for the disposal of brine-oil field wastes are included in this table. Data on these wells are not in sufficient detail to determine the adequacy of these facilities with relation to capacity and operation.

The treatment facilities provided for wastes at the Du Pont and Aluminum Company of America plants are satisfactory in design and operation. The operation and capacity of the facilities used for disposal of oil and toxic wastes from engine repair shops at the 3 Air Force installations are unsatisfactory. The operation and capacity of the facilities at one plant are undetermined.

TABLE F

ADEQUACY OF EXISTING TREATMENT FACILITIES

INDUSTRIAL*

August 1951

Number of Industrial* Treatment Facilities	Adequacy With Relation To:					
	Capacity			Operation		
	Sat.	Unsat.	Undet'd	Sat.	Unsat.	Undet'd
78**	2	3	73**	2	3	73**

* Industries having separate outlets discharging wastes directly to watercourse.

** Includes 72 salt water injection wells, but data do not permit an evaluation of the operation or the capacity of these facilities.

As shown in Table G, 25 new or replacement plants with a total design population of more than 730,000 were completed by municipalities during the six years, 1946 to 1951.

Two industrial waste treatment plants were built during this period but the date of completion and amount of wastes treated are unknown. Since 1947 approximately 72 salt water injection wells were also placed in operation.

TABLE G

PROGRESS IN CONSTRUCTION OF POLLUTION ABATEMENT FACILITIES

August 1951

	Municipal		Industrial*	
Year	Sewage Treatment Plants Completed	Design Population	Waste Treatment Plants Completed	Amount of Waste Treated (In Terms of Equiv. No. People)
1946	1	8,190		
1947	5	39,850	9**	
1948	4	14,000	30**	
1949	3	10,000	10**	
1950	6	635,150	12**	
1951	6	23,100	11**	

* Two industrial wastes treatment plants were built, but completion date and amount of wastes treated are unknown.

** These figures represent the 72 salt water disposal wells which have been completed since 1947.

The Soil Conservation Service of the U. S. Department of Agriculture reports that practically the entire watershed is covered by soil conservation districts and that their office provides technical services to the farmers and ranchers to aid them in applying conservation measures to the land. One of the primary objectives of this program is the reduction of erosion with the resultant reduction of sediment damages. This type of watershed treatment is in effect at the present time.

POLLUTION PREVENTION MEASURES REQUIRED

To properly control pollution caused by municipal sewage from communities in the basin the Texas State Department of Health recommends, as indicated in Table H and L, that the existing plants be replaced at Floresville, Ganado, Halletsville, Legion--V. A. Hospital, Shiner and Waelder, and additions or enlargements be made at Bexar County Home, Brooks Field, Cuero, Edna, Flatonia, Goliad, Karnes City, Kelly Field, New Braunfels, Randolph Field, San Antonio, San Marcos, Seadrift, State Hospital (San Antonio), Victoria, and Yoakum. No project is required at 25 municipal treatment plants. The Texas State Department of Health prefers connection to the city sewerage systems rather than the above recommended improvements for: Brooks Field, Kelly Field, and the State Hospital at San Antonio and the Legion V. A. Hospital at Kerrville. The present construction cost of providing these needed improvements is estimated to be about $3,250,000. This estimate, based on presently known needs, is for capital expenditures only. It does not include cost of land, right of way, collecting sewers, intercepting sewers, etc., nor does it take into account maintenance and operating costs. It is recommended that operation be improved at Flatonia, Karnes City, Legion--V. A. Hospital, San Antonio, Bexar County Home, and Waelder. Map No. 3 indicates graphically the municipal wastes treatment needs for the basin.

TABLE H

WASTE, TREATMENT NEEDS - MUNICIPAL*

August 1951

Needs	Number	Population Served by Facilities
New Plant	None	
Enlargement or Additions to Existing Plant	14**	498,480
Replace Existing Plant	5	11,790
Conn. to City Sewer	3	32,750
No Project Required	25	57,950
Undetermined	None	

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.
** Includes two plants which need chlorination only and one municipality which has a secondary plant of satisfactory capacity but needs final settling units.

INDUSTRIES WITH TREATMENT FACILITIES

INDUSTRIES WITH TREATMENT FACILITIES UNDETERMINED

INDUSTRIES WITH NO TREATMENT FACILITIES

NOTE:

Numbers appearing by symbols indicate total number of industrial sources of pollution in the area in the category designated

Still ponds symbols designated spill water retention ponds

Cross hatching indicates areas of possible pollution from oil wells

GUADALUPE RIVER BASIN
LOCATION MAP

SCALE OF MILES

GUADALUPE RIVER BASIN
SOURCES OF INDUSTRIAL POLLUTION
AND
EXISTING TREATMENT FACILITIES
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 3

34.A

Table I and L indicate the need for industrial waste pollution abatement measures. Only 2 industries provide adequate wastes treatment facilities. Three waste treatment facilities need additions or enlargement, and 1 industry should connect to the city sewer. In the case of one industry the needs still must be determined.

water

Salt/and oil wastes from oil fields should be kept from the waters of the basin and continued efforts maintained to eliminate this type of pollution. The needs for facilities to dispose of these wastes are unknown. These wastes should be recharged into the ground by injection wells or disposed of by other adequately regulated means. Map No. 5 indicates graphically the basin's industrial pollution abatement needs.

To control the pollution load caused by silt, erosion control measures should be intensified throughout the basin. These measures include dams, terraces, contour farming, reforestation, pasture land control, and crop rotation. There have been no detailed studies made to determine the quantitative values as to sources, transportation, suspended loads, and the deposition of sediment in this watershed. It would be necessary to have this information before a solution of the silt problem could be attained.

Brooks, Kelly, and Randolph Air Fields should provide adequate treatment for the oil and toxic substances from the engine repair and plating shops and line maintenance operations.

TABLE I

INDUSTRIAL* WASTE POLLUTION ABATEMENT NEEDS

August 1951

Needs	Number
New Treatment Plant or other Pollution Control Measures	
Enlargement or Additions to Existing Plant	3
Replace Existing Plant	
Connection to Municipal Sewer System	1
No Project Required	2
Undetermined	78**

*Industries having separate outlets discharging wastes directly to watercourse.

**Includes 72 salt water injection wells disposing of oil field wastes from an unknown number of oil wells. The adequacy of these facilities is undetermined.

Table J shows the status of municipal action on pollution abatement needs. Eleven municipalities have taken no action; 7 municipalities are actively planning improvements and have hired a consulting engineer or taken steps to raise the necessary funds; and 4 municipalities have had the necessary plans for improvement approved by the State Department of Health, and 2 have begun construction. Included in the municipalities which are actively planning improvements is the city of Luling which is actively planning enlargements to the sewer systems and the two sewage treatment plants although the plants treat present loads satisfactorily.

Table K shows that there are two industries which are actively planning improvements, one is inactive, and the other falls in the undetermined category.

TABLE J

STATUS OF MUNICIPAL* ACTION ON

POLLUTION ABATEMENT NEEDS

August 1951

Status of Action	Number of Municipalities*
Inactive	11
Active Planning	6**
Final Plans Approved	4
Under Construction	2

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.
** Includes Luling which is actively planning enlargements to the sewer systems and the two sewage treatment plants, and Cuero which has a treatment plant of satisfactory capacity but needs final settling units.

NO POLLUTION ABATEMENT NEEDS

POLLUTION ABATEMENT NEEDS UNDETERMINED

POLLUTION ABATEMENT NEEDED

POLLUTION ABATEMENT NEEDS INDICATED BY LETTERS APPEARING BELOW 'POLLUTION ABATEMENT NEEDED' SYMBOLS, AS FOLLOWS

B ENLARGEMENTS OR ADDITIONS TO EXISTING PLANT

S CONNECTION TO MUNICIPAL SEWER SYSTEM

NOTE:
Numbers next to symbols or next to code letters represent number of pollution abatement needs in the category designated

Salt water symbols designates salt water injection wells

GUADALUPE RIVER BASIN
LOCATION MAP

SCALE OF MILES
0 5 10 20 30

GUADALUPE RIVER BASIN

INDUSTRIAL POLLUTION ABATEMENT NEEDS

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 5

TABLE K

STATUS OF INDUSTRIAL* ACTION ON

POLLUTION ABATEMENT NEEDS

AUGUST 1951

Status of Action	Number of Industries
Inactive	1
Active Planning	2
Final Plans Approved	
Under Construction	
Undetermined	1

* Industries having separate outlets discharging wastes directly to watercourse.

TABLE L

MUNICIPALITIES AND INDUSTRIES NEEDING

IMPROVEMENTS FOR ABATEMENT OF POLLUTION

August 1951

Name and Location	Population Served	Improvements Needed	Remarks
Bexar County Home	200	Enlargement	
Brooks Field	5,000	Chlorination	
Engine Repair Shop	Undet'd	Additions	
Cuero	6,340	Additions	Plans approved
Edna	3,600	Additions	Plans approved
Flatonia	1,164	Additions	
Floresville	2,800	Additions	
Ganado	1,350	Replacement	
Goliad	800	Additions	
Halletsville	2,540	Replacement	Active planning
Karnes City	1,870	Additions	
Kelly Field	30,000	Conn. to city sewer	Under const.
Engine Repair & Plating Shop & Maintenance (line)	Undet'd	Additions	Active planning
Kenedy			
Archer-Daniels-Midland Co.	100	Conn. to city sewer	Active planning
Legion-V. A. Hospital	750	Conn. to city sewer	Active planning
New Braunfels	7,000	Enlargement	Plans approved
Randolph Field	5,000	Chlorination	
Engine Repair Shop & Line Maintenance	Undet'd	Additions	
San Antonio	445,000	Additions & Enlargement	Active planning
Alamo Dressed Beef Co.	Undet'd	Undet'd	Pen wastes
Ed Auge Packing Co.	Undet'd	Undet'd	Pen wastes
Swift & Co., Packing Plt.	Undet'd	Undet'd	Pen wastes
Union Stockyards	Undet'd	Undet'd	Pen wastes
San Marcos	5,000	Replacement	Under const.
Seadrift	200	Additions	
Shiner	1,700	Replacement	
Spoetzel Brewery	Undet'd	Undet'd	
State Hospital (San Antonio)	2,000	Conn. to city sewer	Active planning
Victoria	18,800	Additions	Active planning
Valcar Enterprises	Undet'd	Undet'd	Rendering Plant
Waelder	1,200	Replacement	
Yoakum	710	Additions	Plans approved

APPENDIX

TO

REPORT ON WATER POLLUTION

GUADALUPE RIVER BASIN

August 1951

APPENDIX I
TABLE 1
BASIC DATA ON SOURCES OF MUNICIPAL* POLLUTION
GUADALUPE RIVER BASIN (ENTIRE BASIN IN TEXAS)
August 1951

Name and Location	Mile Above Mouth Outlet Stream	Population Served by Sewers	P.E. (B.O.D.) Untreated Waste**	Waste Treatment Provided	Adequacy of Treatment Facilities Cap'y	Opr.	P.E. (B.O.D.) of Plant Effluent**	Treatment Needs	Current Status of Municipal Action
LAVACA RIVER									
Moulton	L-92	640	undet'd	secondary	sat.	sat.	undet'd	none	
Halletsville	L-74	2,540	2,010	primary	unsat.	sat.	1,650	replacement	act. planning
Rocky Creek	L-65								
Shiner	R-22	1,700	(1,700)	primary	unsat.	sat.	(1,100)	replacement	inactive
Brushy Creek	L-48								
Post Oak Creek	L-25								
Navidad River	L-10								
BRUSHY CREEK									
Yoakum	B-25	4,090	(4,090)	secondary	sat.	sat.	(360)	none	
Supplejack Creek	B-8								
Yoakum	S-14	710	(710)	primary	unsat.	sat.	(320)	addition	final plans app.
POST OAK CREEK									
Drainage Ditch	P-4								
Edna	Dr-1	3,600	2,980	primary	unsat.	sat.	2,080 1/	addition	final plans app.

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.

** Includes industrial wastes discharged into municipal sewerage systems, P.E. (Population Equivalent) of raw wastes is reported as population served or is calculated from actual pounds of B. O. D. in wastes divided by .167-the pounds of B.O.D. produced by one person per day. P.E. of plant effluent is calculated from the P.E. of raw waste and actual or estimated plant efficiencies. P.E.'s in parenthesis estimated.

1/ Discharges to dry watercourses and does not reach live water.
2/ Effluent used for irrigation.
3/ Lagoons temporary.
4/ Effluent goes to lagoons.

Name and Location	Mile Above Mouth Outlet Stream	Population Served by Sewers	P.E. (B.O.D.) Untreated Waste**	Waste Treatment Provided	Adequacy of Treatment Facilities Cap'y	Opr.	P.E. (B.O.D.) of Plant Effluent**	Treatment Needs	Current Status of Municipal Action
NAVIDAD RIVER									
West Navidad River	N-72								
Mustang Creek	N-14								
WEST NAVIDAD RIVER									
Small Creek	W-9								
Schulenburg	S-2	2,000	(2,000)	secondary	sat.	sat.	(200)	none	
MUSTANG CREEK									
Devers Creek	M-6								
Ganado	D-1	1,350	(1,350)	primary	unsat.	sat.	(880)	replacement	inactive
TRES PALACIOS RIVER									
Dry Creek	T-39								
El Campo	Dr-1	7,000	(7,000)	secondary	sat.	sat.	(700)	none	
GUADALUPE RIVER									
Kerrville	Irrigation	7,000	3,450	secondary	sat.	sat.	0[2]	none	
Legion (.25 mi. from Main stem)	G-416	750	(750)	primary	unsat.	unsat.	(490)[2]	conn. to Kerrville sewer	act. planning
Comfort	Irrigation	400	(400)	secondary	sat.	sat.	0	none	
New Braunfels (.25 mi. from Main stem)	G-278	7,000	3,340	secondary	unsat.	sat.	810	enlargement	final plans app.
Seguin	G-255	5,650	(5,650)	secondary	sat.	sat.	(280)	none	
San Marcos River	G-176								
Gonzales	G-172	4,780	(4,780)	secondary	sat.	sat.	(240)	none	
Peach Creek	G-148								
Sandias Creek	G-105								
Cuero (.25 mi. from Main stem)	G-99	6,340	(6,340)	secondary[3]	sat.	sat.	(130)	addition	final plans app.

Name and Location	Mile Above Mouth Outlet Stream	Population Served by Sewers	P.E. (B.O.D.) Untreated Waste**	Waste Treatment Provided	Adequacy of Treatment Facilities Cap'y	Opr.	P.E. (B.O.D.) of Plant Effluent**	Treatment Needs	Current Status of Municipal Action
Victoria	G-50	18,800	(18,800)	secondary	unsat.	sat.	(4,900)	addition	act. planning
Coleto Creek	G-36								
Drainage Ditch	G-19								
Bloomington	Dr-5	500	(500)	secondary	sat.	sat.	(50)	none	
San Antonio River	G-11								
SAN MARCOS RIVER									
San Marcos	S-78	5,000	2,860	secondary	unsat.	sat.	250	replacement	under const.
Dry Channel	S-64								
San Marcos AF	Dr-8	undet'd	undet'd	secondary	sat.	sat.	undet'd	none	
Luling (South)	S-35	1,900	(1,900)	secondary	sat.	sat.	(470)	none	act. planning
Plum Creek	S-26								
PLUM CREEK									
Town Creek	P-21								
Lockhart	T-6	4,000	(4,000)	secondary	sat.	sat.	(200)	none	
Dry Channel	P-4								
Luling (North)	Dr-4	1,900	(1,900)	secondary	sat.	sat.	(190)	none	act. planning
PEACH CREEK									
Dry Branch	P-20								
Flatonia	Dr-10	1,160	(1,160)	secondary	unsat.	unsat.	(930)[1/]	addition	inactive
Baldridge Creek	P-19								
Waelder	B-8	1,200	(1,200)	primary	unsat.	unsat.	(800)	replacement	inactive
SANDIAS CREEK									
Clear Fork Creek	S-37								
Nixon	C-8	1,200	(1,200)	secondary	sat.	sat.	(120)	none	
COLETO CREEK									
Yorktown Creek	C-41								
Yorktown	Y-5	2,000	(2,000)	secondary	sat.	sat.	undet'd	none	

Name and Location	Mile Above Mouth Outlet Stream	Population Served by Sewers	P.E. (B.O.D.) Untreated Waste**	Waste Treatment Provided	Adequacy of Treatment Facilities Cap'y	Opr.	P.E. (B.O.D.) of Plant Effluent**	Treatment Needs	Current Status of Municipal Action
SAN ANTONIO RIVER									
Olmos Creek	S-238								
Bexar County Home	O-3	200	(200)	secondary	unsat.	unsat.	(100)[1]	enlargement	inactive
State Hospital	S-225	2,000	(2,000)	secondary	unsat.	sat.	(1,000)	conn. to San Antonio sewer	act. planning
Dry Creek	S-216								
Brooks AF	Dr-4	5,000	2,280	secondary	unsat.	sat.	75	chlorination	inactive
Medina River	S-210								
Floresville	Irrigation	2,800	(2,800)	secondary	unsat.	sat.	0[2]	addition	inactive
Marcelina Wash	S-143								
Poth	M-12	680	(680)	secondary	sat.	sat.	(70)	none	
Cibolo Creek	S-131								
Escondido Creek	S-113								
Ojo de Agua Creek	S-110								
Runge	C-5	800	(800)	secondary	sat.	sat.	(80)	none	
Goliad	S-68	800	(800)	secondary	unsat.	sat.	(200)	addition	inactive
MEDINA RIVER									
Bandera	M-100	200	(200)	secondary	sat.	sat.	(2)	none	
Leon Creek	M-8								
Kelly AF	L-17	30,000	47,600	secondary	unsat.	sat.	6,400	conn. to San Antonio sewer	under const.
Mitchell Lake	M-6								
San Antonio	Mi-4	445,000	(565,000)	secondary	unsat.	unsat.	undet'd (transition period)	enlargement & addition	act. planning
CIBOLO CREEK									
Boerne	Lagoons	500	(500)	secondary	sat.	sat.	0[4]	none	
Randolph AF	C-58	5,000	4,380	secondary	unsat.	sat.	400	chlorination	inactive

Name and Location	Mile Above Mouth Outlet Stream	Population Served by Sewers	P.E. (B.O.D.) Untreated Waste**	Waste Treatment Provided	Adequacy of Treatment Facilities Cap'y	Opr.	P.E. (B.O.D.) of Plant Effluent**	Treatment Needs	Current Status of Municipal Action
Santa Clara Creek	C-47								
Marion	S-7	360	(360)	secondary	sat.	sat.	0	none	
Clifton Branch	C-23								
Stockdale	Cli-3	400	(400)	secondary	sat.	sat.	(20)	none	
ESCONDIDO CREEK									
Karnes City (West)	Lagoons	200	(200)	secondary	sat.	unsat.	0[4/]	none	
Dry Draw	E-13								
Karnes City (East)	Dr-6	1,870	(1,870)	secondary	unsat.	unsat.	(940)	addition	inactive
Kenedy	E-8	3,600	(3,600)	secondary	sat.	sat.	(360)	none	
TIDEWATER									
Lavaca River									
Tres Palacios River									
Guadalupe River									
Palacios		3,060	(3,060)	secondary	sat.	sat.	(300)	none	
Port Lavaca		5,090	(5,090)	secondary	sat.	sat.	(250)	none	
Seadrift		200	(200)	primary	unsat.	sat.	(130)	addition	inactive

APPENDIX I
TABLE 2
BASIC DATA ON SOURCES OF INDUSTRIAL* POLLUTION
GUADALUPE RIVER BASIN (ENTIRE BASIN IN TEXAS)
August 1951

Name and Location	Miles Above Mouth Outlet Stream	Type of Industry	Type of Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) of Plant Effluent	Pollution Abatement Needs	Current Status of Industrial Action
				Degree	Adequacy Cap'y	Adequacy Opr.			
LAVACA RIVER									
Rocky Creek	L-65								
Shiner	R-22								
Spoetzel Brewery		food	organic	pri	N	N	N	N##	
GUADALUPE RIVER									
Victoria	G-50								
Valcar Enterprises		food	organic	none	--	--	N	N##	
E. I. Du Pont		chemical	undet'd	sec	sat.	sat.	none	none	
SAN ANTONIO RIVER									
San Antonio	S-228								
Alamo Dressed Beef Co. (Pen wastes)		food	organic	none	--	--	N#	N	
Ed Auge Packing Co. (Pen wastes)		food	organic	none	--	--	N#	N	
Swift & Co., Packing Plant (Pen Wastes)		food	organic	none	--	--	N#	N	
Union Stock Yards (Pen wastes)		food	organic	none	--	--	N#	N	
Dry Creek	S-216								
Brooks AF Engine Repair Shop		misc.	org.&inorg.	minor	unsat.	unsat.	N	addition	N

* Industries having separate outlets and discharging directly to watercourse.
\# Pen Wastes only causes nuisance conditions at times.
No problem at present time.
N--Information undetermined or not available.
Note--Table does not include the thousands of producing oil wells in the basin for which information is not available.

Name and Location	Miles Above Mouth Outlet Stream	Type of Industry	Type of Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) of Plant Effluent	Pollution Abatement Needs	Current Status of Industrial Action
				Degree	Adequacy Cap'y	Opr.			
Medina River	S-210								
Cibolo Creek	S-131								
Escondido Creek	S-113								
ESCONDIDO CREEK									
Kenedy	E-8								
Archer-Daniels-Midland Co.		food	organic	none	--	--	100	conn. to city sewer	act. planning
MEDINA RIVER									
Leon Creek	M-8								
Kelly AF Engine Repair and Plating Shops and Line Operations	L-17	misc.	org.&inorg.	minor	unsat.	unsat.	N	addition	act. planning
CIBOLBO CREEK									
Randolph AF Engine Repair Shop and Line Operations	G-58	misc.	org.&inorg.	minor	unsat.	unsat.	N	addition	inactive
TIDEWATER									
Port Lavaca									
Alum. Co. of America		pri. metals	san. sew.	sec.	sat.	sat.	N	none	

TABLE 2 (Cont'd.)

INDUSTRIAL WASTE DATA
OIL FIELD SALT WATER DISPOSAL WELLS
GUADALUPE RIVER BASIN

County and Operator	Oil Field	Waste Treated Before Injection	Method of Injection	Gallons of Waste Per Day	Date Well Completed
CALDWELL					
D. D. Feldman	Luling-Branyon	no	G	N	1949
Humble O&R Co.	Salt Flat	no	P	214,000	1950
" " "	" "	no	P	319,000	1950
" " "	" "	no	P	504,000	1950
McClanahan Oil Co.	Luling-Branyon	no	G	63,000	1948
" " "	" "	no	G	N	1948
Magnolia Pet. Co. (Four Wells)	" "	yes	P	4,284,000	1948
Magnolia Pet. Co.	" "	no	P	840,000	1948
" " "	" "	no	P	840,000	1949
" " "	" "	no	P	336,000	1950
Southern Prop. Co.	Larremore	no	G	29,000	1948
CALHOUN					
Sinclair O&R Co.	Heyser	yes	P	136,000	1950
COLORADO					
Ohio Oil Co.	Nada	no	P	6,000	1949
" " "	"	no	P	21,000	1950
DE WITT					
Wescol O&G Co.	Nordheim	N	N	N	1950
GOLIAD					
Continental Oil Co.	Slick	yes	G	42,000	1947
Sunray Oil Corp.	Slick	no	P	N	1948
GUADALUPE					
Gulf Oil Co.	Darst Cr.	no	G	336,000	1947
" " "	" "	no	G	504,000	1947
" " "	" "	N	N	N	1948
Humble O&R Co.	" "	no	G	164,000	1947
" " "	" "	no	G	168,000	1948
Magnolia Pet. Co.	" "	no	G	147,000	1947
" " "	" "	no	G	189,000	1947
" " "	" "	no	G	630,000	1948
" " "	Luling-Branyon	no	P	462,000	1948
" " "	" "	no	G	535,000	1948
" " "	" "	no	P	903,000	1948
" " "	" "	no	P	756,000	1948
" " "	" "	no	G	N	1948
Riddle Oil Co.	Darst Cr.	N	N	4,000	1948

County and Operator	Oil Field	Waste Treated Before Injection	Method of Injection	Gallons of Waste Per Day	Date Well Completed
The Texas Co.	Darst Cr.	N	G	273,000	1948
" " "	" "	no	G	420,000	1948
" " "	" "	no	G	147,000	1948
Trio Oil Co.	" "	no	G	252,000	1947
United N&S Dev. Co.	" "	N	N	N	1948
JACKSON					
Humble O&R Co.	Lolita	no	G	210,000	1947
" " "	"	N	N	N	1950
" " "	M. La Ward	yes	G	42,000	1951
" " "	Maurdro	yes	G	252,000	1951
" " "	Ganado	no	G	13,000	1951
Magnolia Pet. Co.	W. Ranch	no	G	336,000	1948
" " "	Lolita	no	G	63,000	1949
" " "	W. Ranch	no	G	42,000	1949
" " "	Cordele	no	P	25,000	1951
Wm. L. Pickens	Little Kentucky	no	G	N	1951
" " "	N. La Ward	no	G	15,000	1951
S. W. Richardson	Cordele	no	N	N	1950
Skelly Oil Co.	Lolita	no	G	105,000	1948
KARNES					
So. Minerals Corp.	Falls City	no	G	82,000	1948
" " "	" "	no	P	82,000	1950
MATAGORDA					
Magnolia Pet. Co.	Markham	no	P	29,000	1951
Sun Oil Co.	Midfields	no	P	6,000	1947
VICTORIA					
American Pet. Co.	Bloomington	no	P	50,000	1948
Barnesville Oil Co.	Placedo	no	P	294,000	1948
" " "	McFaddin	no	P	504,000	1949
J&C Drilling Co.	Placedo	N	N	N	1950
Gulf Oil Co.	Heyser	no	G	N	1948
" " "	"	no	G	N	1949
Magnolia Pet. Co.	Placedo	N	N	N	1950
" " "	Heyser	no	P	42,000	1951
Stanoline Oil Co.	E. Placedo	no	G	N	1949
Sun Oil Co.	Heyser	no	P	105,000	1948
" " "	Placedo	no	P	126,000	1949
Sunray Oil Corp.	McFaddin	no	G	N	1948
" " "	Placedo	yes	P	210,000	1951
" " "	"	yes	P	168,000	1951
WHARTON					
Pure Oil Co.	Louise	no	P	105,000	1949
Seaboard Oil Co.	El Campo	no	P	29,000	1951

N-Information not available or undetermined
G-Gravity injection
P-Pressure injection

APPENDIX II

POPULATION OF CITIES

IN GUADALUPE RIVER BASIN

City	County	1930	1940	1950
Alamo Heights	Bexar	3,874	5,700	7,950
Bandera	Bandera		1,325	
Boerne	Kendall		1,271	1,792
Comfort	Kendall		1,100	
Cuero	De Witt	4,672	5,474	7,456
Edna	Jackson	1,752	2,724	3,845
El Campo	Wharton	2,034	3,906	6,216
Flatonia	Fayette		1,024	1,096
Floresville	Wilson		1,708	1,935
Ganado	Jackson		717	1,253
Goliad	Goliad		1,446	1,580
Gonzales	Gonzales	3,859	4,722	5,630
Halletsville	Lavaca		1,581	2,001
Karnes City	Karnes		1,571	2,584
Kenedy	Karnes	2,610	2,891	4,177
Kerrville	Kerr	4,546	5,572	7,665
Legion	Kerr		1,200	
Lockhart	Caldwell	4,367	5,018	5,531
Luling	Caldwell	5,970	4,437	4,285
New Braunfels	Comal	6,242	6,976	12,196
Nixon	Gonzales		1,853	1,867
Olmos Park	Bexar		1,822	2,813
Palacios	Matagorda		2,288	2,913
Port Lavaca	Calhoun		2,069	5,062
Poth	Wilson		509	1,085
Runge	Karnes		1,001	1,078
San Antonio	Bexar	231,542	253,854	406,811
San Marcos	Hays	5,134	6,006	9,961
Schulenburg	Fayette		1,970	1,997
Seguin	Guadalupe	5,225	7,006	9,696
Shiner	Lavaca		1,520	1,775
Stockdale	Wilson		926	1,100
Terrell Hills	Bexar		1,236	2,702
Victoria	Victoria	7,421	11,566	16,102
Waelder	Gonzales		1,018	1,274
Yoakum	Lavaca	5,656	4,733	5,225
Yorktown	De Witt		2,081	2,596

POPULATION OF COUNTIES

GUADALUPE SUB-BASIN

County	Area in Basin (sq. mi.)	Population			Percent Change		1950	
		1930	1940	1950	1930-40	1940-50	Urban	Rural
Bandera	461	2,930	3,278	3,395	12	4	--	3,395
Bastrop	32	499	452	408	-9	-10		408
Bexar	1,177	287,735	332,621	478,954	16	47	420,276	67,678
Blanco	140	953	1,058	936	11	-12		936
Caldwell	464	28,333	22,463	17,383	-21	-23	9,816	7,567
Calhoun	537	5,385	5,911	8,971	10	52	5,062	3,909
Colorado	296	3,944	3,672	3,277	-7	-11		3,277
Comal	567	11,984	12,321	16,325	3	33	12,196	4,129
De Witt	910	27,441	24,935	22,912	-9	-8	10,052	12,860
Fayette	230	8,721	8,306	6,852	-5	-18		6,852
Gillespie	30	177	172	169	-3	-2		169
Goliad	583	7,248	6,318	4,454	-13	-29		4,454
Gonzales	1,058	28,337	26,075	21,000	-8	-20	5,630	15,370
Guadalupe	715	28,925	25,596	25,337	-12	-1	9,696	15,641
Hays	382	11,147	11,472	13,299	3	16	9,961	3,338
Jackson	854	10,980	11,720	12,889	7	10	3,845	9,044
Karnes	652	21,152	17,462	14,502	-17	-11	6,761	8,741
Kendall	622	4,797	4,903	5,214	2	6		5,214
Kerr	915	9,478	10,878	13,028	15	20	7,665	5,363
Lavaca	975	27,550	25,485	22,122	-8	-13	3,148	18,974
Matagorda	387	5,171	5,869	6,294	14	7	2,913	3,381
Medina	282	2,759	3,176	3,350	15	5		3,350
Refugio	12	400	540	524	35	-3		524
Victoria	893	20,048	23,741	31,174	18	31	16,102	15,072
Wharton	406	12,151	14,803	14,724	22	-1	6,216	8,508
Wilson	717	16,212	15,714	13,481	-3	-17		13,481

APPENDIX III

ADMINISTRATIVE AGENCIES

The following agencies exercise some degree of control over the waters of the Guadalupe River Basin.

Local

Comal-Hayes-Guadalupe Soil Conservation District

Guadalupe-Blanco River Authority

Bexar-Medina-Atascosas County Water Improvement District No. 1

Upper Guadalupe River Authority

San Antonio River Canal and Conservancy District

Gulf Water Supply District

Bexar County Water Control and Improvement District Nos. 1 through 8

Bexar County Metropolitan Water District

Comal County Water Reclamation District No. 1

Jackson County Flood Control District

Lavaca County Flood Control District

Bandera County Water Control and Improvement District

Kendall County Water Control and Improvement District

Victoria County Water Control and Improvement District

Entire Basin

Texas State Department of Health

Texas Game and Fish Commission (formerly Texas Game, Fish and Oyster Commission)

Texas Board of Water Engineers

Texas Railroad Commission

Texas State Land Commission

Texas State Park Service

Corps of Engineers, Department of the Army

U. S. Fish and Wildlife Service, Department of the Interior

U. S. Department of Agriculture

APPENDIX IV

GUADALUPE RIVER BASIN

WATER SUPPLIES

Municipality	Water Use	Population Served	Type of Supply	Gallons Per Day
Alamo Heights	Mun.	10,000	Ground	1,000,000
Bandera	Mun.	1,500	Ground	100,000
Bexar Co. Home		No Information		
Blessing	Private		Ground	
Bloomington	Mun.	500	Ground	30,000
Boerne	Mun.	1,800	Ground	200,000
Brooks Air Field		No Information		
Castroville	Mun.	990	Ground	99,000
Comfort	Mun.		Ground	50,000
Cuero	Mun.	8,000	Ground	1,000,000
Edna	Mun.	3,200	Ground	200,000
El Campo	Mun.	7,000	Ground	400,000
Falls City	Private	500	Ground	15,000
Fentress	Private	700	Surface	100,000
Flatonia	Mun.	1,000	Ground	75,000
Floresville	Mun.	2,500	Ground	300,000
Ganado	Mun.	650	Ground	40,000
Goliad	Mun.	1,400	Ground	100,000
Gonzales	Mun.	6,000	Surface	600,000
Halletsville	Mun.	2,100	Ground	250,000
Ingram		No Information		
Karnes City	Mun.	2,500	Ground	65,000
Kelly Air Field		No Information		
Kenedy	Mun.	4,000	Ground	400,000
Kerrville	Mun.	10,125	Ground	1,500,000
Kyle	Mun.	1,080	Ground	100,000
La Vernia		No Information		
Legion	Mun.	2,000	Ground	150,000
Lockhart	Mun.	5,800	Ground	500,000
Luling	Private	5,000	Ground	300,000
Marion	Mun.	450	Ground	25,000
Martindale	Private	500	Ground	
Moulton	Mun.	850	Ground	50,000
New Braunfels	Mun.	15,000	Ground	1,500,000
Nixon	Private	2,100	Ground	100,000
Olmos Park			City of San Antonio	
Palacios	Mun.	3,500	Ground	200,000
Port Lavaca	Mun.	6,000	Ground	500,000
Poth	Mun.	800	Ground	175,000
Randolph Air Field		No Information		
Runge	Mun.	800	Ground	40,000
San Antonio	Mun.	350,000	Ground	40,000,000

Municipality	Water Use	Population Served	Type of Supply	Gallons Per Day
San Marcos	Mun.	6,500	Ground	500,000
Schulenberg	Mun.	2,200	Ground	110,000
Seguin	Mun.	12,000	Surface	1,360,000
Shiner	Mun.	1,600	Ground	100,000
State Hospital			City of San Antonio	
Stockdale	Mun.	1,100	Ground	60,000
Terrill Hills	No Community Supply			
Victoria	Mun.	13,000	Ground	1,500,000
Waelder	Mun.	1,200	Ground	200,000
Westhoff		No Information		
Yoakum	Mun.	7,000	Ground	350,000
Yorktown	Mun.	2,200	Ground	200,000

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